

## **Chapter 4**

# **SOLUTION DEVELOPMENT**

### **STORAGE AND CONVEYANCE IMPROVEMENTS NECESSARY TO MEET GOALS**

The Policy Advisory Committee (PAC) for the Northern Palm Beach County Comprehensive Water Management Plan (NPBCCWMP) identified a large number of project elements that could be used in different combinations to create many different modeling scenarios. Performance of each scenario and its component elements towards achieving the planning goals and objectives was evaluated through use of the models. A complete list of elements is included in **Table 1**. Of the more than 40 elements proposed, the following were determined by the PAC to be most successful toward achieving the goals and objectives of this plan. Further descriptions of modeling assumptions, and the design and operation of these improvements are provided in the Technical Support Document, Volume II.

- Provide 48,000 acre-feet of storage in a single or multiple reservoirs located in either the Southern L-8 Basin or the Southern L-8 and C-18 basins.
- Provide 50 million gallons per day (mgd) of aquifer storage and recovery (ASR) capacity.
- Increase the pumping capacity from the L-8 Canal into the M-Canal up to 300 cubic feet per second (cfs).
- Increase the conveyance capacity of the M-Canal up to 450 cfs.
- Provide additional wastewater reuse of 10 mgd.
- Provide up to 150 cfs of conveyance capacity from the regional system to the C-18 Basin. One of the identified routes for this connection was through the Grassy Waters Preserve. Major constraints on delivery of water by this route are the presence of Northlake Boulevard and the need to avoid excessive water levels in the Grassy Waters Preserve. The proposed facility and appurtenant works needed to convey water under Northlake Boulevard are referred to as the "G-161 Structure" to be consistent in nomenclature used for other nonfederal, South Florida Water Management District (SFWMD) structures.
- Backpump from tributaries of the C-17 Canal into a 550-acre stormwater treatment area (STA), which subsequently discharges to the Grassy Waters Preserve.
- Construct a structure in the Loxahatchee Slough that is capable of providing more precisely controlled and measured discharges of 0-100 cfs, less precisely controlled discharges from 100 to 500

**Table 1. List of Alternatives by Basin**

<b>Southern L-8 Basin</b>	
<b>Conveyance Changes within the Subarea</b>	
M-Canal Expansion	
New West Palm Beach Control 2 (Existing Site or Moved East)	
<b>Storage Mechanisms</b>	
Palm Beach Aggregate Surface Water Reservoir	
ASR wells	
Stormwater Treatment Area (STA) in Section 1 just west of the Grassy Waters Preserve	
Convert Indian Trail Improvement District (ITID) Impoundment to a STA	
Expanded capacity of ITID's Impoundment	
<b>Conveyance Out of the Study Subarea</b>	
Diversions to west leg of C-18	
Diversions to Lake Worth Drainage District (LWDD) via C-51	
Diversions to tide via C-51	
<b>Additional Features</b>	
The redirection of flows from ITID's impoundment through a new conveyance canal directly south to the L-8 Canal would allow removal of existing canal/levees and allow restoration of sheet flow from the J.W. Corbett Wildlife Refuge south toward the L-8 Canal.	
<b>Grassy Waters Preserve/Water Supply Lakes</b>	
<b>Conveyance of Water Into the Subarea</b>	
New West Palm Beach Control 2 (Pump Station)	
Input of high quality, Advanced Wastewater Treatment (AWT) Reuse Water	
Diversions from C-17 Basin	
<b>Conveyance Within the Subarea</b>	
M-Canal Expansion	
New West Palm Beach Control 3	
New West Palm Beach Control 4	
<b>Storage Mechanisms</b>	
Revise Grassy Waters Preserve Regulation Stage	
Increase Functional Grassy Waters Preserve Footprint (Alternative Sites 1 and/or 2)	
Aquifer Storage and Recovery (ASR) wells	
<b>Conveyance Out of the Subarea</b>	
Increased Flow to C-18/Loxahatchee Slough under Beeline (operational schedule)	
Increase Water Treatment Plant Withdrawals	
Diversions to C-17 (tide)	
Diversions to C-51 (tide)	
Diversions to LWDD via C-51	
<b>Loxahatchee Slough Basin</b>	
<b>Conveyance Into the Study Subarea</b>	
Diversions (pump) from C-14 to C-18 from South Indian River Water Control District (SIRWCD)	
Diversions to C-18 (Loxahatchee Slough) from the Grassy Waters Preserve	
Diversions to west leg of C-18 from L-8 Basin (ITID)	
Diversions to west leg of C-18 from L-8 Basin (Corbett)	
Diversions to Slough National Area from SIRWCD	
<b>Conveyance within the Study Subarea</b>	
New C-18 Structure	
Turnpike Ditch Structure	
Caloosa Water Control Structure/System	
Siphon Under west leg of C-18	
Increased C-18 Conveyance/Modify All Affected Structures	
<b>Storage Mechanisms</b>	
Raise Loxahatchee Slough Stage to Meet Restoration Hydroperiod	
Reservoir along west leg of C-18	
Aquifer Storage and Recovery (ASR)	
C-18 Canal Stage	
<b>Conveyance Out of the Study Subarea</b>	
Establish Minimum Flow and Level Criteria for G-92 to the Northwest Fork	
Target Flow for S-46 to Southwest Fork	
Jupiter Wellfield Recharge Canal	
Seacoast (Hood Road) Wellfield Recharge System	
Back Flow/Pump to Grassy Waters Preserve	

cfs, and a maximum discharge of 1,100 cfs. This proposed structure and appurtenant works is termed "G-160", to be consistent in nomenclature with other nonfederal, SFWMD structures.

- Install conveyance improvements to provide additional recharge in an area susceptible to saltwater intrusion within the Town of Jupiter.
- Reroute excess surface water runoff from Old Marsh and East Point into the Mirasol stormwater system to provide groundwater recharge, water quality enhancement, and maintain lakes and wetlands, before discharge into the Loxahatchee Slough, east of C-18 Canal.

## **LOXAHATCHEE RIVER MINIMUM FLOWS AND LEVELS**

The SFWMD is statutorily charged (Section 373.0420 F.S.) with the responsibility to define and prevent "significant harm", by establishing minimum flow and level (MFL) criteria for priority water bodies within its jurisdiction. The process of prioritizing water bodies and establishing MFL rules is governed by administrative rules that ensure due process. The Northwest Fork of the Loxahatchee River was originally designated for MFL development by December 2001 under this process. Draft numeric criteria were developed in May 2001 and were peer reviewed by a panel of experts during June 2001. Based on the results of this review and other comments received, the technical document, and the criteria, are being revised. A new technical criteria report will be available in May 2002. SFWMD staff intend to complete rule development and obtain final Governing Board approval for Loxahatchee River MFLs in late 2002.

The final MFL rule, in conjunction with a clear statement of restoration goals and objectives, will ultimately become a basis for the future management of water for the Northwest Fork of the Loxahatchee River. Compliance may require that operational schedules and protocols, and perhaps additional facilities, must be developed or improved within the northern Palm Beach County water management system, especially the Loxahatchee Slough and Grassy Waters Preserve. Additional improvements to water management systems in southern Martin County may also be required to provide this water.

It is important to note that the process of developing the numeric MFL criteria for the Northwest Fork of the Loxahatchee River has proceeded on a path parallel to development of this Comprehensive Water Management Plan. Certain assumptions were made in this plan regarding baseflows and hydroperiod performance targets for the Loxahatchee River and Loxahatchee Slough. In the MFL development process, the SFWMD is undertaking a more comprehensive examination of the impacts of river flow on salinity and water resources in the river, including effects on floodplain cypress, macroinvertebrate, fish, seagrass, oyster, and other communities. The final MFL significant harm standard will be somewhat different from the preliminary targets used in

this plan with respect to baseflows, and will also include duration or return frequency criteria as recommended by the scientific peer review panel.

Modeling results indicated that with full implementation of the recommended program of improvements, a baseflow of 65 cfs to the Northwest Fork of the Loxahatchee River could be achieved, except during significant drought conditions (**Table 2**). This may or may not be within the allowable ranges of frequency and severity constraints that will be defined by the forthcoming MFL criteria.

**Table 2.** Ability of Proposed Improvements To Meet Interim Flow Target of 65 cfs at the Lainhart Dam, Northwest Fork of the Loxahatchee River.

Scenario	Anticipated Completion Date	Percent of Time Target (65 cfs) Flow Was Met over the Nine-Year Simulation Period
Existing Conditions (1995 Base)	Current	41
With G-160 Project Only	2004	62
With G-160 and G-161 in Place	2006	71
With 2020 LECRWSP Projects in Place	2011-2018	99

Section 373.042(1) also requires that if the proposed MFL criteria are not currently being met, a MFL "Recovery and Prevention Strategy" must be developed. This strategy identifies the process and time frames by which the adopted MFL will be achieved. The strategy may involve development of improved operations, additional structural features for water storage or delivery, and/or regulations that protect water resource functions.

## PERFORMANCE

The modeling results presented in the Technical Support Document (Volume II) indicate that the identified program of improvements met the defined targets for agricultural and utility water supply and achieved hydroperiod restoration of the Loxahatchee Slough. As shown in **Table 2**, under current conditions, flows of 65 cfs or more occur less than half (41 percent) of the time. With the G-160 and G-161 improvements in place, these flows could be achieved 71 percent of the time.

With all of the identified improvements in place, the target flow of 65 cfs to the Northwest Fork of the Loxahatchee River could be met more than 99 percent of the time. During the very few periods when discharges over Lainhart Dam fell below 65 cfs (e.g., during the 1989-90 drought), flows were simulated as 50 cfs for approximately one week and 35 cfs for two weeks. The flow over Lainhart Dam was maintained at 35 cfs or higher throughout the entire simulated drought period.

The results in **Table 2**, based on modeling, indicate that until the projects proposed in the Lower East Coast Regional Water Supply Plan (LECRWSP) are constructed, extended periods may occur when the flows over Lainhart Dam are below the baseflow target of 65 cfs. The impacts of not meeting the baseflow targets for Northwest Fork of the Loxahatchee River are discussed below. This information provides a basis for possible actions that can be taken in the interim period before a program of improvements is fully operational.

## **ASSOCIATED BENEFITS**

The entire program of identified improvements will require many years to complete. Construction of water projects of this scope and magnitude often requires more than a decade. Implementation of the identified improvements involves some Comprehensive Everglades Restoration Plan (CERP) components, including the siting of a single or multiple reservoirs that provide a combined storage volume of 48,000 acre-feet, acquisition of required lands, and construction. Local stakeholders have identified projects that could be implemented to achieve benefits sooner. In order to implement these interim projects, the local stakeholders must identify funding sources, develop agreements and schedules, and determine project management responsibilities. The purpose of the following discussion is to explain why specific projects should be expedited in order to reduce detrimental effects that will continue to occur if action is delayed.

The technical analyses revealed that certain adverse effects are intermittently ongoing and others are expected to arise due to future demands. These impacts include water shortages and environmental impacts. More detailed examination of one structural component is used to illustrate the factors involved. The C-18 Basin's performance is compared under existing "without project" conditions to an interim future condition when flowway improvements are provided that increase the gravity flow capacity from the Grassy Waters Preserve to the Loxahatchee Slough.

### **Performance without Improved Conveyance from Grassy Waters Preserve to Loxahatchee Slough**

During predevelopment times, water from the vicinity of the Grassy Waters Preserve could flow north to the Loxahatchee Slough. However, the flow barrier created by construction of Northlake Boulevard and increased water demands by the City of West Palm Beach have reduced flow from the preserve to the Loxahatchee Slough. The current flow is negligible when the preserve is at or below a stage of 18.5 feet relative to the National Geodetic Vertical Datum (NGVD).

In the interim period, until a gravity flow connection is built, the 65 cfs target flow to the Loxahatchee River can be met only 41 percent of the time (**Table 2**). The Loxahatchee Slough provides a supplemental water supply sufficient to maintain a flow of approximately 30 cfs over Lainhart Dam if the stage in the slough is above its target hydroperiod. During dry periods, the other tributaries and ground water inflows will provide approximately 10 cfs of additional flow for a total of approximately 40 cfs

downstream of the confluence of Kitching Creek and the Northwest Fork of the Loxahatchee River. Providing 40 cfs instead of the target 65 cfs will result in movement of saltwater approximately 0.5 mile upstream of the confluence at Kitching Creek.

## **Performance with Improved Conveyance from Grassy Waters Preserve to Loxahatchee Slough**

Hydraulic analyses indicate that up to 44 cfs can flow by gravity between the Grassy Waters Preserve and the Loxahatchee Slough with conveyance improvements both upstream and downstream of the existing 72-inch diameter culverts under Northlake Boulevard. In order to meet the full 150 cfs design criteria, additional more substantial improvements would be needed. For the existing culverts to be effective, the perimeter canal south of Northlake Boulevard must be improved and new culverts placed under the entrance road to the Nature Center (located on the south side of Northlake Boulevard). Once completed, these changes will provide significant benefits to the Loxahatchee Slough and the Northwest Fork of the Loxahatchee River.

Modeling studies indicate that in normal rainfall years the Loxahatchee Slough has limited water above its target hydroperiod available for release to supplement the baseflows to the Northwest Fork of the Loxahatchee River. During a typical three-month dry period, when local runoff to the Northwest Fork of the Loxahatchee River is insufficient to provide the target baseflow of 65 cfs, the actual daily flow results in a cumulative deficit of approximately 5,000 acre-feet. If the Loxahatchee Slough were full (17.5 feet NGVD) at the start of the dry season, only about 2,500 acre-feet of water would be available for discharge to the Northwest Fork of the Loxahatchee River to maintain baseflow. This number is approximately half of the normal demand, which strongly suggests that the Loxahatchee Slough cannot be the sole source of baseflow for the Northwest Fork of the Loxahatchee River. Under these conditions, extended periods frequently occur when baseflow targets cannot be met.

The addition, in the near term, of 44 cfs flow from the Grassy Waters Preserve would reduce the dry season deficit to approximately 1,000 acre-feet and essentially shorten the duration of hydroperiod deficit by one month. If the slough stage is at 17 feet NGVD at the end of the wet season, the benefit of receiving approximately 1,000 acre-feet of supplemental water from the preserve would be that the Loxahatchee Slough would reach a stage at the end of the dry season of 15.5 feet NGVD, approximately one month later than was predicted for "without" project conditions.

In conclusion, a phased approach to implementing the recommended improvements should be considered to meet baseflow targets in the Northwest Fork of the Loxahatchee River. This approach involves initially reconnecting the Grassy Waters Preserve to the Loxahatchee Slough by gravity driven conveyances while more elaborate facilities are being constructed to provide the improved flow capacity and storage that are needed to better protect the Northwest Fork.